PATENT
Attorney Docket No. 23635-218007

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
APPLICATION FOR UNITED STATES LETTERS PATENT

INVENTOR : Steven E. Guzorek
2969 Ravenwood Drive
Kinston, North Carolina 28504
Citizenship: US

TITLE: **WATER HEATER WITH MECHANICAL DAMPER**

ATTORNEY(S): Joseph H. Paquin, Jr.
Margaret M. Duncan
John G. Bisbikis
Matthew E. Leno
Stephen T. Scherrer
Patrick D. Richards
Gilberto Hernandez
Joy Ann G. Serauskas (Patent Agent)

MCDERMOTT, WILL & EMERY
227 West Monroe Street
Chicago, IL 60606-5096
tel. no. (312) 372-2000
fax no. (312) 984-7700

WATER HEATER WITH MECHANICAL DAMPER

TECHNICAL FIELD

[0001] The present subject matter relates generally to systems for venting exhaust fumes generated by gas hot water heaters. More particularly, the present subject matter relates to a venting system for a gas hot water heater having a mechanical damper.

BACKGROUND

[0002] Hot water heaters are commonly used to provide hot water for use in homes, offices and other residential and commercial buildings. Hot water heaters can be electric or gas powered. Gas powered hot water heaters generally have a main gas burner that is located underneath a water tank. When the burner is operating, it burns a gas, such as natural gas or LP gas, to generate heat which heats the water in the tank. The burner creates combustion fumes as byproducts of burning the gas. The fumes must be vented to outdoor air and usually are carried away or exhausted through a main exhaust pipe which generally passes through the center of the water tank to the top of the tank. At the top of the tank, the main exhaust pipe cooperates with another exhaust pipe that allows the fumes to flow to outside air.

[0003] Controlled flow of the gas and exhaust fumes is important to safety as well as the efficiency of the gas water heater. When the burner is operating, the exhaust pipe must be maintained open in order to allow the exhaust fumes to pass through. When the burner is not operating, however, it can be desirable to close the exhaust pipe to prevent heat from leaving the tank through the exhaust pipe.

[0004] It is therefore desirable to provide a low cost, effective and reliable damper for the exhaust pipe of hot water heaters.

SUMMARY

[0005] The present concepts provide a method and system for operatively damping the exhaust pipe of a hot water heater.

[0006] It is an object of the present subject matter to improve the efficiency of gas hot water heaters by reducing heat loss when the burner is off.

[0007] It is an object of the present subject matter to provide a reliable damper system that opens automatically upon operation of the main burner.

[0008] It is an object of the present subject matter to provide a damper system that closes automatically when the main burner is not operating.

[0009] The following drawings and description set forth additional advantages and benefits of the subject matter. More advantages and benefits will be obvious from the description and may be learned by practice of the subject matter .

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present subject matter may be better understood when read in connection with the accompanying drawings, of which:

[0011] Figure 1 shows a gas water heater with a mechanical damper assembly.

[0012] Figure 2A shows a perspective view of a mechanical damper assembly.

[0013] Figure 2B shows a front view of a mechanical damper assembly.

[0014] Figure 2C shows a top view of a mechanical damper assembly.

[0015] Figure 3 shows a pressure operated drive unit and a gearing mechanism of the mechanical damper assembly.

[0016] Figure 4 is a schematic diagram of one example of a hot water heater burner, valve control unit and damper assembly.

[0017] Figure 5 is a schematic diagram of a second example of a hot water heater burner, valve control unit and damper assembly.

[0018] Figure 6 is a schematic diagram of a third example of a hot water heater burner, valve control unit and damper assembly.

[0019] Figure 7 is a schematic diagram of a fourth example of a hot water heater burner, valve control unit and damper assembly.

DETAILED DESCRIPTION

[0020] Figure 1 shows a hot water heater 10. The hot water heater 10 has a tank 12 to hold the water, a pipe 14 to supply the tank with cold water to be heated, a pipe 16 to let hot water out of the tank and a tube or pipe 18 with a pressure relief valve 20 for releasing water if too much pressure is generated inside the tank 12. The heater 10 also has a burner 22 located under the water tank 12 for heating water inside of the tank 12. An exhaust vent or pipe 24 is also provided for allowing combustion fumes from the burner 22 to be exhausted away from the area around the heater 10, preferably to an outdoor area. As shown, the exhaust vent 24 passes through the center of the tank 12. The burner 22 is coupled to a valve control unit 26 via a gas tube or pipe 28. The valve control unit 26 is also coupled to a mechanical damper assembly 30 via another gas tube or pipe 32. The valve control unit 26, which will be described in more detail below, contains one or more valves which selectively control flow of gas to and operation of the burner 22 and damper assembly 30.

[0021] As shown in more detail in Figures 2A, 2B, 2C and 3, the damper assembly 30 has a drive unit 34, an axle 36, a damper 38 and a housing 40. The axle 36 may be a single axle or a series of axles coupled together by gearing mechanisms as shown. The

drive unit 34 is pressure-operated. As shown, the drive unit 34 has a pressure diaphragm 42, such as a bellows mounted within a diaphragm housing 43. The housing 43 can be any shape so long as it creates a pressure cavity into which gas can be supplied to create a pressure on the diaphragm 42. The diaphragm housing 43 is connected to a mounting plate 45 which can be attached to the heater 10. The diaphragm 42 can be biased to a first position in normal atmospheric pressure, but can move to a second position when a certain pressure level is applied to one side of the diaphragm 42. As shown in Figure 1, the drive unit 34 can be installed on a heater 10 such that the diaphragm 42 is in a generally horizontal plane. A rod 44 having a rack 46, can be connected to the diaphragm 42. The rack 46 engages a pinion 48 on or connected to an axle 36. The axle 36 is thus rotated upon movement of the rack 46. The damper 38 is also coupled to the axle 36, directly or through a series of axles and gears, and thus is also rotated upon movement of the rack 46. Movement of the diaphragm 42 from the first position to the second position, and vice-versa, causes translational movement of the rack 46, which causes rotation of the axle 36 and damper 38. For example, movement of the diaphragm 42 from the first position to the second position may cause clockwise rotation of the axle 36 and damper 38 to an open position (as will be described below) and movement of the diaphragm 42 from the second position back to the first position may cause counter-clockwise rotation of the axle 36 and damper 38 back to a closed position (as also described below).

[0022] The damper 38 may be mounted to the housing 40. The housing 40 can be used to better position the damper 38 on top of the heater 10, over the exhaust vent 24 and under a hooded outdoor exhaust vent 39. When the damper 38 is rotated to a closed position, it, along with the housing 40, can completely or at least substantially cover the

exhaust vent 24. When the damper 38 is rotated to an open position it will substantially not cover the exhaust vent 24.

[0023] The damper 38 can be set to the closed position when the burner 22 is not running to prevent heat loss through the exhaust vent 24. The damper 38 can be set to the open position when the main burner 22 is running so that exhaust fumes can flow out of the exhaust vent 24.

[0024] A first example of a configuration for a valve control unit 52 and damper assembly 54 that can be used with a hot water heater is shown schematically in Figure 4. The valve control unit 52 is coupled to a pilot burner 56, a main burner 58 and a pressure drive unit 76. Gas is supplied to the control unit 52 via a gas inlet pipe 60. The control unit 52 operatively allows gas to flow to the pilot burner 56, main burner 58 and the pressure drive unit 76 via gas pipes 77. The pilot valve 62 can be maintained open manually, e.g., when a person is lighting the pilot burner 56 initially, and/or by a thermocouple circuit 64 which includes a thermocouple 66 which activates the pilot valve 62 to maintain it open while the pilot burner 56 is lit. A safety spill switch 68 can be coupled to the thermocouple circuit 64. The safety spill switch 68 has a detector (not shown) which can be positioned near the top of the water heater, but in an area where no exhaust gas should be present. If the detector detects the presence of exhaust gas, e.g. by sensing an extremely high temperature, it will cause the switch 68 to open and thereby cause the pilot valve 62 to close, preventing gas from flowing to the pilot burner 56.

[0025] The control unit also is coupled to a thermostat 72, such as mechanical thermostat, that can be screwed into the hot water tank. When the thermostat 72 senses a water temperature that is cold enough, a diaphragm 74 in the thermostat 72 will push

open and allow gas to flow through the control unit 52 to the main burner 58 as well as a damper drive unit 76. As gas flows to the main burner 58, the main burner 58 will ignite causing the water in the tank to heat up. At the same time, gas will flow to the pressure operated damper drive unit 76, creating a pressure on the diaphragm 42 or bellows (see Figures 2 and 3). The pressure should be sufficient enough to cause the bellows to move from the first position to the second position, thereby moving the rack and pinion mechanism (see Figures 2 and 3) and causing the damper 82 to rotate to an open position.

[0026] As shown in Figure 4, the axle 84 is connected to the damper 82 to create a non-central pivot point. For the circular damper 82 in Figure 4, the non-central pivot point is created by attaching the axle 84 slightly off-center, i.e., it does not pass directly through the diameter of the circular damper 82 such that the distance D1 is less than the distance D2. By creating a non-central pivot point, the damper 82 is not balanced on the axle 84. Accordingly, gravity can assist in rotation of the damper, for example from the open position to the closed position. This can help ensure that the damper closes when the main burner 58 is not operating. In addition, the weight of the rod 44 also assists in moving the diaphragm 42 back to the first position when gas pressure is no longer applied.

[0027] When the thermostat 72 reaches a warm enough temperature that it shuts off the gas supply to the main burner 58 and the damper drive unit 76, the damper 82 will close due to the lack of gas pressure on the diaphragm 42, which will return to its first biased position, but also with the assistance of gravity pulling on the heavier side (D2) of the damper 82 and the rod 44.

[0028] In this example the procedure for operating the main burner would generally follow the following steps: lighting the pilot burner; maintaining the burner as a lit so long a no flue gas is spilling from the exhaust tube; as long as the pilot light is lit, and when the thermostat allows gas to flow to the main burner and drive unit, lighting the main burner and opening the damper; maintaining the main burner as lit and the damper open until the thermostat shuts off the supply of gas; and then shutting off the main burner and closing the damper

[0029] A second example of a configuration of a valve control unit 102 and damper assembly 104 is shown schematically in Figure 5. The valve control unit 102 is coupled to a pilot burner 108 and a main burner 116. Gas is supplied to the control unit 102 via a gas inlet pipe 107. The control unit 102 operatively allows gas to flow to the pilot burner 108, main burner 116 and the pressure drive unit 124 via gas pipes 115. The pilot burner valve 106 in this example can be mechanically held open to light the pilot burner 108 and/or maintained open by the thermocouple circuit 110 having a thermocouple 111, similar to the circuit 64 in the first example. In this example, however, the thermostat 112 is a remote mount thermostat coupled to a circuit 114. Accordingly, when the thermostat 112 senses a certain temperature at which the main burner 116 should light to heat water in the tank, the thermostat 112 activates a switch 118. When the switch 118 is activated, the circuit 114 is completed that causes a drive unit valve 122 to open. When the drive unit valve 122 is opened, gas will flow to a pressure drive unit 124, causing a damper 126 to rotate or move to an open position (as described above) and to activate a safety switch 128 when it reaches the open position. When the safety switch 128 is activated, a second circuit 130 is completed, which causes

the main burner valve 132 to open and supply gas to the main burner 116. Accordingly, the main burner 116 will not receive a supply of gas and therefore will not operate unless the damper 126 is open.

[0030] In this example the procedure for operating the main burner would generally follow the following steps: lighting the pilot burner; maintaining the burner as a lit; upon a signal from the thermostat, activating a circuit to open the drive unit valve to allow gas to flow to the pressure drive unit and opening the damper; upon opening the damper, activating another circuit to open the main burner valve and allow gas to flow to the main burner to heat the water in the tank; and when the water temperature reaches a predetermined temperature, causing the thermostat to deactivate the first circuit to prevent gas from flowing to the pressure drive unit, thereby closing the damper and deactivating the second circuit to thereby close the main burner valve and turn off the main burner.

[0031] A third example of a configuration of a valve control unit 152 and damper assembly 153 is shown schematically in Figure 6. The valve control unit 152 is coupled to a pilot burner 156, a main burner 172 and a pressure drive unit 164. Gas is supplied to the control unit 152 via a gas inlet pipe 157. The control unit 152 operatively allows gas to flow to the pilot burner 156, main burner 172 and the pressure drive unit 164 via gas pipes 171. The pilot burner valve 154 in this example can be mechanically held open to light the pilot burner 156 and/or maintained open by the thermocouple circuit 158 having a thermocouple power pile 159, similar to the previous examples. In this example, however, like the first example, the thermostat 160 is mechanical thermostat. When the thermostat 160 senses a water temperature that is cold enough, a diaphragm 162 in the

thermostat 160 will push open and allow gas to flow through the control unit 152 to a damper drive unit 164 causing a damper 166 to move to an open position (as described above) and to activate a safety switch 167 when it reaches the open position. When the safety switch 167 is activated, a circuit 168 is completed, which causes the main burner valve 170 to open and supply gas to the main burner 172. Accordingly, the main burner valve 170 will not open and the main burner 172 will not operate unless the damper 166 is in an open position.

[0032] In this example the procedure for operating the main burner would generally follow the following steps: lighting the pilot burner; maintaining the burner as lit; when the water temperature is cool enough, causing the thermostat to allow gas to flow to the pressure drive unit and open the damper; upon opening the damper, closing a safety switch to activate a circuit to open the main burner valve and allow gas to flow to the main burner to heat the water in the tank; and when the water temperature reaches a predetermined temperature, causing the thermostat to shut off the supply of gas to the drive unit thereby closing the damper and opening the safety switch to thereby close the main burner valve and turn off the main burner.

[0033] A fourth example of a configuration of a valve control unit 182 and damper assembly 184 is shown schematically in Figure 7. The valve control unit 182 is coupled to a pilot burner 186, a main burner 198 and a pressure drive unit 194. Gas is supplied to the control unit 182 via a gas inlet pipe 187. The control unit 182 operatively allows gas to flow to the pilot burner 188, main burner 198 and the pressure drive unit 194 via gas pipes 195. The pilot burner valve 186 in this example can be mechanically

held open to light the pilot burner 188 and/or maintained open by the thermocouple circuit 190 having a thermocouple 191, like in the previous examples.

[0034] In this example, the thermostat 192 is mechanical thermostat. When the thermostat 192 senses a water temperature that is cold enough, a diaphragm 194 in the thermostat 192 will push open and allow gas to flow through the control unit 182 to a damper drive unit 194 and a solenoid valve unit 196 coupled to the main burner 198. The gas flowing to the pressure drive unit 194 causes a damper 200 to open (as described above) and also to activate a safety switch 202. When the safety switch 202 is activated, a circuit 204 having a thermopile 205, which works in conjunction with the thermocouple 191, is completed, and causes a valve 206 in the solenoid valve unit 196 to open and allow gas to flow to the main burner 198. Accordingly, the solenoid valve unit valve 206 will not open and the main burner 198 will not operate unless the damper 200 is rotated to an open position.

[0035] In this example the procedure for operating the main burner would generally follow the following steps: lighting the pilot burner; maintaining the burner lit; when the water temperature is cool enough, causing the thermostat to allow gas to flow to the pressure drive unit and to a main burner valve unit; causing the pressure drive unit to open the damper, and upon opening the damper, closing a safety switch to complete a circuit to cause a valve in the main burner valve unit to open the supply gas to the main burner to ignite the burner and heat the water in the tank; and when the water temperature reaches a predetermined temperature, causing the thermostat to shut off the supply of gas to the pressure drive unit and main burner valve unit, thereby closing the damper and

opening the safety switch to thereby deactivate the circuit and close the main burner valve, to stop the supply of gas to the main burner, thereby turning the main burner off.

[0036] While the foregoing has described what are considered to be the best mode and/or other examples, it is understood that various modifications may be made therein and that the technology disclosed herein may be implemented in various forms and examples, and that they may be applied in numerous applications, only some of which have been described herein. It is intended by the following claims to claim any and all modifications and variations that fall within the true scope of the advantageous concepts disclosed herein.